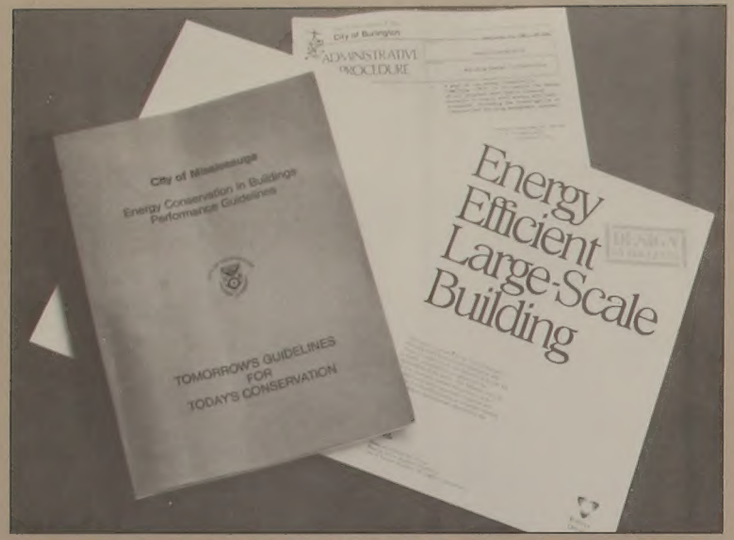

Municipal governments can reduce operating costs by ensuring their new buildings are designed for energy efficiency.

Additional Guidelines for Energy Efficient Buildings

City of Mississauga

The City of Mississauga's design guidelines, entitled *Energy Conservation in Buildings Performance Guidelines*, help the City evaluate the energy efficiency of proposed new City-owned buildings as well as improve the operating efficiency of existing buildings. The guidelines include a discussion of building design and insulation levels, building orientation and landscape features, mechanical systems, lighting, maintenance and operational practices. Contractors hired by the City are required to consider the guidelines when designing a building.

City of Toronto

The City of Toronto also developed a set of energy efficiency guidelines for new buildings, entitled *Energy Efficient Large Scale Buildings: Design Guidelines*. Directed at private developers, the guidelines apply to new buildings (office, apartment and multi-use buildings) in excess of 1,860 square meters (20,000 square feet). Written to assist private sector developers make informed energy efficiency choices, the document discusses building form and orientation, architectural features, windows and glazing, mechanical systems, and interior design. Notably, the document recommends the use of computer energy analysis programs.

City of Burlington

The City of Burlington developed building design considerations in February 1983. They encourage energy conservation to be considered in building designs where economically feasible. Before tendering a new building design the City's architect/engineer must submit the design to the Energy Conservation Committee for review and explain the energy provisions incorporated into the design. These guidelines were used to develop the specification for the Burlington Mainway Recreation Centre.

For further information contact:

Call (416) 965-6471

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Municipal Conservation Group
56 Wellesley Street West
10th Floor
Toronto, Ontario
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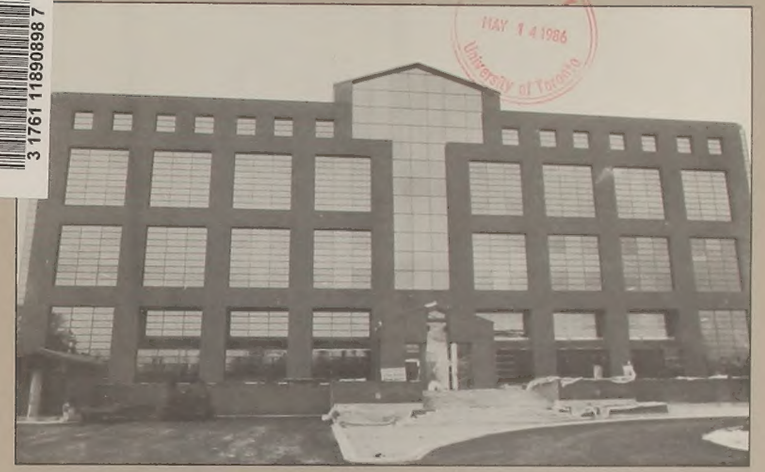
Energy Conservation in New Buildings



The recently constructed Phoenix Building in the Regional Municipality of Ottawa-Carleton incorporates several energy efficient features to minimize long-term operating costs.

Owners and managers of many commercial and institutional buildings find today's high energy costs a burden. It's a well known fact that energy bills can account for a substantial percentage of a building's operating costs. Once a building is constructed however, there are physical and financial limits to improving energy efficiency. It makes more sense to incorporate energy efficiency into a building's design right from the start.

Energy efficient features often add no more than five to ten per cent to the cost of a building. In addition, equipment costs are often lower because smaller heating and air conditioning units are required.

What features can maximize energy efficiency in a new building? What design standards or guidelines are currently in practice? How do owners and operators decide what features to install? What extra costs are involved? What savings can be realistically expected?

This case study examines state-of-the-art energy efficiency guidelines and the experiences of three municipal-level governments which are attempting to improve the energy efficiency of new buildings under their jurisdictions.

Energy Efficiency Guidelines for New Buildings

Although all new commercial and institutional buildings constructed in Canada must comply with provincial building codes, these regulations,

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Honourable Vincent G. Kerrio
Minister

Energy Ontario

(with the recent exception of the Quebec Building Code) are concerned primarily with safety matters. Several Canadian governments (including federal, provincial and municipal governments) are implementing energy efficiency standards for new buildings to cut long term operating costs and provide examples for private sector builders.

City of Ottawa Guidelines

As part of a three-year Energy Action Plan, Ottawa's all-volunteer Energy Advisory Committee, recently prepared the following four recommendations to improve the energy efficiency of new institutional/commercial/industrial (I.C.I.) buildings as follows:

1. The City adopt energy use design guidelines for large (ie. 600 square meters or greater) new (City-owned) buildings, based on the existing *NRC Measures for Energy Conservation in New Buildings 1983**

2. The City require developers to submit a mechanical engineering report that recommends ways to improve energy efficiency. The report should describe the options examined, justify the options chosen and recommend design features to improve energy efficiency.

3. All large new buildings occupying City-owned land be required to meet the NRC guidelines.

4. The City should encourage efficient design when involved in preliminary negotiations with the developers of major projects.

The ICI guidelines were reviewed by two standing committees of Council — the Planning Committee and the Physical Environment Committee. The Committees have directed the guidelines back to the Community Development Department for cost analysis of implementation. Attempting to achieve an acceptable balance between energy efficiency and budget constraints, the guidelines have been the subject of some controversy.

While some Energy Advisory Committee and City Council members felt that the NRC guidelines are not stringent enough, others argued that the City cannot justify spending the time and money to develop improved guidelines. Others voiced concern about the City's financial ability to follow the guidelines.

Mark Lawton, chairman of the ICI subcommittee of the Energy Advisory Committee thinks it's largely a matter of education. He comments, "Once people realize that the purpose of these recommendations is to save money, there shouldn't be a problem. In fact, a lot of private developers are voluntarily following the guidelines right now." Lawton explains that the subcommittee does not want to force anyone to follow the guidelines. They just want to encourage the City, and private developers, to consider energy efficient design and its obvious benefits. They also want the City to set an example for the private sector."

How much does energy efficient design add to the initial cost of the building? "It depends on the measures selected but sometimes," he points out, "the additional cost is minimal because energy efficient construction means you can downsize your operating equipment."

Although the future of the ICI guidelines is still uncertain, Lawton and other subcommittee members are confident that energy efficient design is destined to be an integral part of all large new buildings simply because it is so economical.

Regional Municipality of Ottawa-Carleton

A similar initiative was launched recently in the Regional Municipality of Ottawa-Carleton. Also concerned about reducing the high cost of operating municipally-owned buildings, Regional Council passed a policy in January 1985 stating: "Any new office structure commissioned or leased by the Regional Municipality of Ottawa-Carleton shall be designed so that the energy consumption will not exceed 12 kWh per square foot per year. All structures exceeding 12 kWh per square foot per year must obtain approval from the Office of Energy Conservation before proceeding with the final design."

Peter Kozlowski, Energy Coordinator for the Region, in consultation with other Regional employees and Council, developed the policy to provide a greater degree of control over the design of new municipal buildings. The energy consumption limit of 12 kWh per square foot per year, derived through an extensive literature review and discussions with office building developers, is regarded as a fairly stringent, although not impossible goal.

Kozlowski explains that the standard is an energy efficiency target only. It may not be practical in some situations, for example, you can't expect a filtration plant or pumping station to conform, but it will result in much more efficient buildings. By contrast, the energy consumption rate of most new office buildings ranges from 20 to 30 kWh per square foot per year.

Similar consumption standards are being prepared for other types of municipal buildings, including a home for the aged, a garage depot and a sewage treatment plant. These standards will be performance standards — like the 12 kWh per square foot per year office building standard — or prescriptive standards — like the NRC guidelines specifying levels of insulation, glazing, air tightness etc. Kozlowski prefers performance standards because, "Total energy performance and efficiency in the building is ensured."

The recently constructed 9,290 square meter (100,000 square foot) Phoenix Building was designed with the new consumption standard in mind. Housing the Region's Health Unit, Social Services Department and the Works Department, the office building features insulation to NRC standards; 250 perimeter heat pumps (for heating and cooling) and 21 internal heat pumps; reflective double glazed windows; zone thermostats with override timers to allow local temperature control after business hours; energy efficient fluorescent lighting; and a computer monitoring and control system.

After the first year of operation, the Phoenix building exceeded the energy target. However, Kozlowski points out that the building was still under construction and the computer control system wasn't operating at top efficiency. "We're bound to see a marked improvement during the 1985/86 heating season and I don't think we'll have a problem reaching our goal," he concludes.

A second office building — the Regional Headquarters — is scheduled for construction in 1988. Comprising a renovated historical building and a new office tower, the new Regional Headquarters will be designed to meet the energy efficiency standard.

**The National Research Council (NRC) guidelines are based on* Standard 90 A, *developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).* Standard 90 A, *issued in 1980, is an updated version of the original (1975)* Standard 90. *Since 1975, energy consumption in new U.S. buildings has plummeted by 50 per cent. The original* Standard 90 *guidelines are incorporated into the building codes of every U.S. state.*

The NRC guidelines, modified to reflect Canadian conditions and objectives, cover recommended standards for thermal resistance of building envelopes (including exterior walls, windows, doors, roofs and skylights), building air tightness, and operating standards for ventilating, heating, cooling and lighting systems.

Unlike the recommendations made by Ottawa's ICI subcommittee, the Ottawa-Carleton policy has generated virtually no controversy. "The 12 kWh per square foot per year standard will reduce our energy costs for new office buildings by about two thirds" states Kozlowski. "Any initial extra cost is obviously a sound investment in the Region's future. Energy retrofits are expensive. It's much more economical to design for energy efficiency up front." Kozlowski is also convinced that private developers will inevitably follow the Region's lead.

The new energy-efficient Regional Headquarters of the Regional Municipality of Ottawa-Carleton will comprise the renovated Teachers College (shown above) and a new office tower.

Built-in Energy Conservation at New Burlington Twin Pad Arena

The new 1,580 square meter (17,000 square foot) Burlington Mainway Recreation Centre is one of the City of Burlington's first opportunities to put energy efficient design into practice. Scheduled for completion in September 1986, the complex will house two (year round) ice pads; 12 change rooms; two referees' rooms, a staff room, a main office, one mechanical room and seven storage rooms, in addition to a meeting room. Total seating capacity for the two rinks is just over 1,000.

"Because it's a long standing City policy to keep energy costs to a minimum", explains Art Mushlian, Superintendent of Recreational Operations, "the Council was behind this effort one hundred per cent. But we still had to justify every proposed measure in terms of savings potential and the quality of the Centre."

The new Recreation Centre will incorporate metal halide lighting (High Intensity Discharge) with a dimmer system that allows lighting intensity to match the activity on the ice, thus reducing electricity consumption. A deionized water purification system, which produces water that freezes at higher temperatures (0 degrees C), results in a harder, smoother ice surface and reduces ice resurfacing requirements, will also be installed. Deionizing systems save energy by reducing compressor cooling load, and reducing the amount of water required for resurfacing. A heat recovery unit that uses waste compressor heat to melt the snow deposited by the ice resurfacing machine and to heat resurfacing water, will also be installed. In addition, a brine pump control system which allows the ice temperature to rise a few degrees at night (to slightly below the freezing point) will minimize compressor cooling load and reduce electricity consumption.

Additional energy saving features include high efficiency compressor motors which will cut electricity consumption and a computer-controlled energy monitoring and temperature control system to balance energy demand with energy requirements. The computer will also ensure equipment operates at top efficiency. Eventually, all Burlington arenas will be tied into this micro-computer system.

The City of Burlington is supplying most of the $4.5 million required for the project. A Lottario grant and funds raised by user groups are also contributing to the project.

Mushlian concludes, "The energy efficient features will add only 2 per cent to the cost of the arena, and most of the investments have a payback of three years or less. In addition, the quality of the rinks will be first rate and we'll have a Centre we can be proud of."

Energy Saving Features of New Burlington Mainway Recreation Centre

FEATURE	COST	EST. ANNUAL SAVINGS	PAYBACK (years)
H.I.D. dimming control system	$19,000	$6,000	3.2
Compressor heat recovery	17,000	7,000	2.4
High efficiency motors (9 motors)	2,108*	1,262	1.7
Brine pump control	970	3,880	0.25
Microprocessor monitoring and control system	45,000 (est)		less than 5 years**
Deionized water system (2 systems)	lease arrangement***		

**The $2,108 is the additional cost for the high efficiency motors compared to standard motors. The full cost is $12,832. The price for these high efficiency motors is about 20 per cent higher than for standard motors.*

***At this time an accurate payback period for the microprocessor is difficult to determine. Based on the performance of similar systems in other recreational buildings, however, it is expected to be less than five years. Also, additional savings will result when the other Burlington arenas are tied into the system. Note that the $45,000 price includes installation costs as well as the cost of hardware and software.*

****Normally, one system costs about $15,000.*

Life Cycle Costing and Computer Energy Analysis Programs:

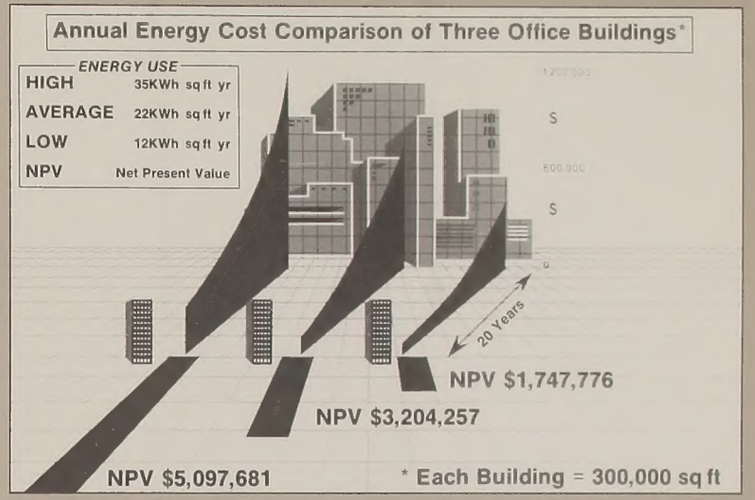
Life cycle costing (LCC) analysis is a decision making tool used to compare the long-term costs and savings of building design and building equipment alternatives. LCC analysis takes all factors into consideration: initial capital investment; operating costs (including maintenance and repair costs); energy costs and equipment replacement.

All operating costs (long term costs) are converted into "present value dollars" to compensate for the changing value of money over time.

Inflation, interest rates and energy price changes are taken into account.

Several computer energy analysis programs that perform LCC analyses and also predict the overall energy consumption of a new building based on various design and equipment alternatives, are available.

The Regional Municipality of Ottawa Carleton is considering using the DOE 2 computer program (produced by the American federal government's Department of Energy). DOE 2, which also performs LCC analyses, lets decision makers see in advance how much energy a new building will consume and compare the long term benefits of numerous design and equipment options.



Twenty-year energy costs are compared for three office buildings with low, average and high energy consumption rates.